

Mr. Robert H. Leyse
P.O. Box 2850
Sun Valley, ID 83353

Dear Mr. Leyse:

I am responding to your letter of May 1, 2002, by which you submitted a petition for rulemaking (PRM) requesting that the Nuclear Regulatory Commission (NRC) amend 10 CFR Part 50, Appendix K, and the supporting guidance in NRC Regulatory Guide (RG) 1.157, "Best Estimate Calculations of Emergency Core Cooling System (ECCS) Performance."

Your letter contended that amendments are necessary to correct the failure of Appendix K and RG 1.157 to consider the complex thermal hydraulic conditions present during a loss-of-coolant accident (LOCA), including the potential for very high fluid temperatures.

The NRC published a notice of receipt of PRM-50-76 on August 9, 2002 (67 FR 51783). Six letters of public comment were received on the petition, including three from you. The other three letters opposed the petition arguing that runaway oxidation is prevented by the 2200 °F peak cladding temperature limit and that the Baker-Just correlation is known to be conservative, overpredicting the zirconium-water reaction by as much as 30% at the limiting temperature (2200 °F). It was also commented that the conditions of FLECHT run 9573 (high power and high initial temperatures) were extremely severe, intentionally beyond design basis for ECCS performance and that the Cathcart-Pawel tests had adequate steam flow, so that the zirconium-water reaction rate was not limited by the availability of steam and the tests were therefore, valid. It was commented that differences between ECCS test conditions and reactor core fluid conditions during postulated LOCAs do not prevent the current zirconium-water reaction database from being applicable to ECCS analysis. The other public comments generally indicated that within the range of test parameters applicable to ECCS evaluation models, as specified in Appendix K and RG 1.157, the regulations and guidance are valid and conservative.

The Commission is denying your petition for rulemaking (PRM-50-76) for the following reasons:

The Baker-Just correlation using the current range of parameter inputs is conservative and adequate to assess Appendix K ECCS performance. Data sets published since the Baker-Just correlation was developed have demonstrated the conservatism of the correlation above 1800 °F.

The parabolic/Arrhenius behavior of the Cathcart-Pawel isothermal experiments confirmed that there was adequate steam. An NRC analysis has confirmed that the ORNL/ANL assessment that the Cathcart-Pawel isothermal experiments were not steam starved and therefore the experimental data is valid.

Contrary to your assertion that there has not been appropriate testing to address issues raised by run 9573, the NRC has continued to study complex thermal-hydraulic effects on ECCS heat transfer processes during accident conditions related to LOCAs consistent with Commission direction. The NRC funded more than 50 Zircaloy clad bundle reflood experiments at the National Research Universal (NRU) reactor. The NRC is currently conducting and evaluating experimental and analytical programs on fuel cladding behavior (e.g., the effects of fuel relocation, other zirconium-based cladding, high burnup, mixed oxides, ZrO_2 phase change hysteresis, and system pressure) to evaluate the adequacy of current § 50.46 oxidation-related criteria and models.

You did not consider the Westinghouse metallurgical analyses performed on the cladding for all four FLECHT Zircaloy clad experiments reported in WCAP-7665. You also ignored Westinghouse's application of the Baker-Just correlation to these experiments, which had the "complex thermal hydraulic phenomena" that is an issue in your petition. This application of the correlation to the metallurgical data demonstrates the conservatism of the Baker-Just correlation to 21 typical temperature transients. The NRC also applied the Baker-Just correlation to the FLECHT Zircaloy experiments with nearly identical results, confirming the application in WCAP-7665.

For the development of oxidation correlations, limited by oxygen diffusion into the metal, well-characterized isothermal tests are more important than the complex thermal hydraulics. Your suggested use of complex thermal hydraulic conditions would be counter-productive in reaction kinetics tests because temperature control is required to develop a consistent set of data for correlation development. Isothermal tests allow this needed temperature control. It is appropriate to apply the developed correlations to more prototypic transients (including complex thermal hydraulic conditions) to verify that the proposed phenomena embodied in the correlations are limiting. This is what was done by Westinghouse in WCAP-7665, by Cathcart and Pawel in NUREG-17 and by the NRC in the technical safety analysis of your petition (ADAMS Accession No. ML041210109).

The NRC applied the Cathcart-Pawel oxygen uptake and ZrO_2 thickness equations to the four FLECHT Zircaloy experiments, confirming the best-estimate behavior of the Cathcart-Pawel equations for large-break LOCA reflood transients. The NRC applied the Cathcart-Pawel oxide thickness equation to 15 of their transient temperature experiments. The equation was conservative or best-estimate for 13 experiments and nonconservative for the remaining two. This result is consistent with the application of the Cathcart-Pawel equations, which are intended for use in best-estimate LOCA calculations in accordance with RG 1.157.

The NRC staff evaluated your request for rulemaking and concludes that the requested action would not contribute to maintaining safety or security, nor would it improve regulatory efficiency and effectiveness, realism, or timeliness. None of the technical issues that you raised have shown safety-significant deficiencies in the research, calculation methods, or data used to support ECCS performance evaluations. NRC's technical safety analysis demonstrates that current procedures for evaluating performance of ECCS are based on sound science and that no amendments to the NRC's regulations and guidance documents are necessary. Further

R. Leyse

3

details are given in the enclosed Notice of Denial of Petition for Rulemaking, which will be published in the *Federal Register*.

Sincerely,

Annette L. Vietti-Cook,
Secretary of the Commission

Enclosure: *Federal Register* Notice of Denial of
Petition for Rulemaking